



Course: Renewable Energy and Distributed Generation– 0933786 (3 Cr. Course)

Catalog Data: Renewable energy. Wind power generation. Solar photovoltaic generation. Distribution networks. Distributed Generation. Power flow studies. Fault studies. Power quality studies. Protection studies. Connection costs and charges. Allocation of losses. Pricing of distribution networks with DG.

Prerequisites by Course: None

Textbook: None

References:

- [1] N. Jenkins, R. Allan, P. Crossley, D. Kirschen, and G. Strbac, " Embedded generation, " 2000.
- [2] N. Jenkins, " Distributed generation: The Institution of Engineering and Technology, " 2010.
- [3] W. H. Kersting, "Distribution system modeling and analysis," 2012.

Schedule & Duration: 16 Weeks, 48 lectures, 50 minutes each (including exams).

Course Objectives: This course aims to develop understanding of various renewable generation technologies and connection issues on distribution networks. This course also provides the students with methodologies to assess the technical and economic impacts of DG on distribution networks.

Course Learning Outcomes and Relation to Program Learning Outcomes:

Upon successful completion of this course, the student should be able to:

1. Understand the challenges of DG connections on distribution networks. [i,ii]
2. Assess the technical impact of distributed generation by performing power flow, fault, power quality and protection studies. [i ,ii, iii]
3. Evaluate the contribution of distributed generation to network security. [i,ii]
4. Understand the concept of pricing of distribution networks, losses allocation and connection charges with renewable generation. [i,ii]

Course Topics:

	Topic Description	Hrs
1.	Introduction: Drivers for sustainable energy, policy, incentives schemes.	2
2.	Wind power generation: wind Turbine, wind power curve, wind Speed statistics, energy Calculation, types of wind Turbine Systems, Torque and Speed characteristics, Power and Reactive control of wind turbine.	6
3.	Solar Photovoltaic (PV) generation: Technologies, PV System components, energy calculation, system costs.	6
4.	Distribution Networks with Distributed Generation: Introduction to distribution networks, technical issues of DG (Network voltage, Fault level, power quality, protection).	6
5.	Technical impact Studies: Power flow, Fault, Power quality and protection Studies.	12
6.	Impact of distributed generation on network design: network security.	4
7.	Pricing of distribution networks with DG: Connection costs and charges. Distribution use of system charges, allocation of losses.	6

Ground Rules: Attendance is mandatory and highly encouraged. To that end, attendance will be taken every lecture. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessments: Exams, projects, and term papers.

Grading policy:

Semester work	60 %
Final Exam	40 %
Total	100%

Computer Usage: students are encouraged to write/use computer programs for mathematical modelling.

Attendance: Class attendance will be taken and the University policy on absence will be followed.

Instructor:

Instructor Name	Office	Ext.	E-mail
Dr. Sahban Alnaser	EE	--	S.alnaser@ju.edu.jo

Program learning outcomes:

- i Demonstrate a sound, in-depth and up-to-date technical knowledge in the field of specialization.
- ii Ability to identify and solve engineering problems in their chosen field of study.
- iii Acquire the skills for continued professional development and independent self-study.
- iv Demonstrate the ability to communicate technical information effectively and professionally both orally and in writing..

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